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APOLLO MISSION C',

ALTERNATE 1

PRELIMINARY ATTITUDE SEQUENCE

VOLUME II

LUNAR ORBIT

Mission Design Section

TRW Systems Group

MISSION PLANNING AND ANALYSIS DIVISION

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PROJECT APOLLO

APOLLO MISSION C', ALTERNATE 1
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VOLUME II - LUNAR ORBIT

By C. R. Hunt, Mission Design Section
TRW Systems Group

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MISSION PLANNING AND ANALYSIS DIVISION
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VOLUME II - LUNAR ORBIT

By Mission Design Section, TRW Systems Group

SUMMARY

A preliminary attitude sequence for the lunar orbit phase of the C' Mission has been presented. The trajectory used in the analysis is for a vehicle launched December 21, 1968, on the 72-degree launch azimuth. The trajectory data were furnished by the Mission Planning and Analysis Division. The results of the analysis were verified using the Apollo Reference Mission Program and the Apollo Mission Attitude Requirements Program. The mission rules and procedures were obtained primarily from attendance and participation in data priority meetings and liaison with appropriate mission planning activities at MSC. The attitude sequence is compatable with the preliminary Apollo 8 flight plan except for two recent changes concerning the ECS radiator constraint deletion and provision of additional S-band communications prior to the circularization burn which are incorporated in this report.

A detailed orbit-by-orbit description of the attitudes have been presented along with supporting schematic diagrams. An event timeline, referenced to mission time has been included for convenience and the availability of S-band communications has been described.

INTRODUCTION

This report presents a preliminary C' lunar orbit attitude sequence. The attitude sequence is for a December 21, 1968, launch date with a 72-degree launch azimuth. The sequence is compatible with the preliminary Apollo 8 flight plan, Reference 1.

The attitude sequence is presented in three basic parts: a detailed description of each revolution, an event timeline referenced to mission time (Table 1), and schematic diagrams representing the major events and attitudes during each revolution. Detailed look angle and attitude data are available and will be presented in the C' Reference Attitude Sequence.

It is fully recognized that changes in procedures and event sequences will occur subsequent to the publication of this report. Any such changes will be reflected in the reference attitude sequence or addenda thereto. Comments are solicited, particularly those concerning conflicts with other mission planning considerations, so that updates to the reference attitude sequence document will reflect the latest mission planning.

DISCUSSION

First Revolution (Figure 1)

The sequence of significant events that occur during the first revolution is as follows:

1. First lunar orbit insertion (LOI_1) burn
2. Acquisition of MSFN line-of-sight
3. Enter darkness
4. IMU realignment
5. Loss of MSFN line-of-sight
6. Enter sunlight
7. Lunar observation and photography

The first LOI burn deboosts the CSM from the cislunar trajectory into a 60-nautical mile by 170-nautical mile elliptical parking orbit. The burn is performed with the CSM in a retrograde attitude, and the crew is heads down to afford visual reference with the lunar surface. The LOI_1 burn attitude is held inertially fixed until immediately prior to acquisition of MSFN line-of-sight. The CSM is then rolled 180 degrees to establish S-band communications. The resulting attitude is held inertially fixed until loss of MSFN line-of-sight. This inertially fixed attitude satisfies the attitude requirements for the IMU realignment which occurs immediately after the CSM enters darkness. At the loss of MSFN line-of-sight, the CSM is maneuvered to an attitude which allows lunar visual observation and photography. The vehicle attitude, with respect to the local horizontal orientation, is a pitch of minus 45 degrees and a roll of 180 degrees. This attitude is held locally fixed through the completion of the first revolution.

This attitude sequence allows S-band communications from the acquisition of MSFN line-of-sight to the loss of MSFN line-of-sight.

Second Revolution (Figure 2)

The sequence of significant events that occur during the second revolution is as follows:

1. Lunar observation and photography
2. Acquisition of MSFN line-of-sight
3. Enter darkness
4. IMU realignment
5. Loss of MSFN line-of-sight
6. Enter sunlight

At the completion of the first revolution, the CSM is in a locally fixed attitude which allows lunar visual observation and photography. The local attitude hold is maintained until approximately seven minutes prior to the

CSM entering into darkness. At this time, the local attitude hold is terminated and the existing vehicle attitude is held inertially fixed. This inertially fixed attitude satisfies the attitude requirements for the IMU realignment which occurs about five minutes after the CSM enters darkness. Approximately eight minutes prior to the loss of MSFN line-of-sight, the inertial attitude hold is terminated, and the CSM is maneuvered to the circularization burn attitude. The CSM is first maneuvered to an attitude which is rolled 180 degrees from the burn attitude to allow S-band communications. After the loss of MSFN line-of-sight, the CSM is rolled minus 180 degrees into the circularization burn attitude. This attitude is held inertially fixed through the remainder of the second revolution.

This attitude sequence allows S-band communications from the acquisition of MSFN line-of-sight to the loss of MSFN line-of-sight.

Third Revolution (Figure 3)

The sequence of significant events that occur during the third revolution is as follows:

1. Circularization burn
2. Landmark familiarization and training photography
3. Acquisition of MSFN line-of-sight
4. Pseudo landing site landmark familiarization and photography
5. Enter darkness
6. IMU realignment
7. Orbital navigation photography
8. Loss of MSFN line-of-sight
9. Enter sunlight

Immediately following the start of the third revolution, the circularization burn is performed. The circularization burn transforms the initial elliptical parking orbit into a 60-nautical mile circular orbit. The burn is performed with the CSM in a retrograde attitude, and the crew is heads down to afford visual reference with the lunar surface. After the burn, the CSM burn attitude is held inertially fixed for approximately ten minutes. The CSM is then maneuvered to an attitude which allows landmark familiarization and photography. In this exercise the CSM X-axis cameras are given the same pointing profile that the CSM shaft drive axis (SDA) will have during landmark sightings. The vehicle attitude, with respect to the local horizontal orientation, is a pitch of minus 52.5 degrees and a roll of 180 degrees. This attitude is held locally fixed until the CSM cameras become pointed at the pseudo landing site landmark (Table 2). A manual pitch rate is then initiated to keep the cameras pointed at the landmark. Approximately 1.5 minutes after the CSM passes the closest point of approach to the landmark, the pitch rate is terminated, and the vehicle is pitched minus 70 degrees. The resulting attitude is held inertially fixed. This inertially fixed attitude satisfies the attitude requirements for the IMU realignment occurring approximately seven minutes after the CSM enters darkness. The inertial attitude hold is maintained until approximately 19 minutes before the CSM enters sunlight. The

inertial attitude hold is then terminated, and the CSM is maneuvered to an attitude which allows orbital navigation photography. The vehicle attitude, with respect to the local horizontal orientation, is a pitch of minus 90 degrees and a roll of 180 degrees. This attitude is held locally fixed while the CSM X-axis cameras perform vertical stereo photography. The CSM windows are oriented away from the sun to allow better photography. This attitude is held locally fixed through the completion of the third revolution.

Except for a small period of time during the photography of the pseudo landing site landmark, this attitude sequence allows S-band communications from the acquisition of MSFN line-of-sight to the maneuver to the orbital navigation photography attitude.

Fourth Revolution (Figure 4)

The sequence of significant events that occur during the fourth revolution is as follows:

1. Orbital navigation photography
2. Acquisition of MSFN line-of-sight
3. Landmark lighting evaluation
4. Enter darkness
5. IMU realignment
6. Loss of MSFN line-of-sight
7. Enter sunlight

At the start of the fourth revolution, the CSM is in the locally fixed orbital navigation photography attitude. The local attitude hold is maintained, and the vehicle is rolled minus 180 degrees as it passes over the subsolar point to orient the windows away from the sun. Approximately 13 minutes before the CSM passes the closest point of approach to the pseudo landing site landmark, the CSM is maneuvered to the initial tracking attitude for the Mode III type landmark sighting attitude sequence (Figure 5). The attitude at the beginning of a Mode III type tracking sequence, with respect to the local horizontal orientation, is a pitch of five degrees. This attitude is maintained locally fixed until the CSM is about three minutes from the closest point of approach to the landmark. The CSM is then given a minus 0.3 degrees per second pitch rate to keep the landmark in the optics field of coverage throughout the tracking period. Approximately 1.5 minutes after the CSM passes the closest point of approach to the landmark, the pitch rate is terminated. This Mode III type tracking sequence is used for the landmark lighting evaluation of the pseudo landing site landmark. After the tracking sequence is terminated, the CSM is rolled 180 degrees to gain S-band communications, and the resulting attitude is held inertially fixed. This inertially fixed attitude satisfies the attitude requirements for the IMU realignment occurring approximately nine minutes after the CSM enters darkness. About seven minutes before the CSM enters sunlight, the inertial attitude hold is terminated, and the CSM is maneuvered to the initial landmark tracking attitude for a Mode III type landmark sighting sequence, which occurs early in the fifth revolution on the second control point landmark (Table 2). The initial landmark sighting attitude, which is a pitch of five degrees with respect to the local horizontal orientation, is held locally fixed through the completion of the fourth revolution.

This attitude sequence allows S-band communications from the completion of the landmark evaluation to the loss of MSFN line-of-sight.

Fifth Revolution (Figure 6)

The sequence of significant events that occur during the fifth revolution is as follows:

1. Landmark sighting on the second control point landmark
2. Acquisition of MSFN line-of-sight
3. Landmark sighting on the pseudo landing site landmark
4. Enter darkness
5. IMU realignment
6. Loss of MSFN line-of-sight
7. Enter sunlight

At the beginning of the fifth revolution, the CSM is in the locally fixed initial landmark tracking attitude. A Mode III type landmark sighting sequence is performed on the second control point landmark (Table 2), and then the vehicle is maneuvered back to the initial landmark tracking attitude for a Mode III type landmark sighting sequence on the pseudo landing site landmark. After the completion of the sighting sequence on the pseudo landing site landmark, the CSM is rolled 180 degrees to gain S-band communications, and the resulting attitude is held inertially fixed, This inertially fixed attitude satisfies the attitude requirements for the IMU realignment occurring approximately 15 minutes after the CSM enters darkness. About the time the CSM enters sunlight, the inertial attitude hold is terminated and the CSM is maneuvered to the initial landmark tracking attitude for a Mode III type landmark sighting sequence, which occurs early in the sixth revolution on the second control point landmark. The landmark sighting attitude is held locally fixed through the completion of the fifth revolution.

This attitude sequence allows S-band communications from the completion of the landmark sighting sequence on the pseudo landing site landmark to the loss of MSFN line-of-sight.

Sixth Revolution (Figure 7)

The sequence of significant events that occur during the sixth revolution is as follows:

1. Landmark sighting on the second control point landmark
2. Acquisition of MSFN line-of-sight
3. Landmark sighting on the pseudo landing site landmark
4. Enter darkness
5. IMU realignment
6. Loss of MSFN line-of-sight
7. Enter sunlight
8. Landmark sighting on the first control point landmark

At the beginning of the sixth revolution, the CSM is in the locally fixed initial landmark tracking attitude. A Mode III type landmark sighting sequence is performed on the second control point landmark, and then the vehicle is maneuvered back to the locally fixed initial landmark tracking attitude for a Mode III type landmark sighting sequence on the pseudo landing site landmark. After the completion of the sighting sequence on the pseudo landing site landmark, the CSM is rolled 180 degrees to gain S-band communications, and the resulting attitude is held inertially fixed. This inertially fixed attitude satisfies the attitude requirements for the IMU realignment occurring approximately 13 minutes after the CSM enters darkness. About five minutes before the CSM enters sunlight, the inertial attitude hold is terminated, and the CSM is maneuvered to the initial landmark tracking attitude for a Mode III type landmark sighting sequence on the first control point landmark (Table 2). After the completion of the sighting sequence, the vehicle is maneuvered back to the locally fixed initial landmark tracking attitude for a Mode III type landmark sighting sequence, which occurs early in the seventh revolution on the second control point landmark. The initial landmark sighting attitude is held locally fixed through the completion of the sixth revolution.

This attitude sequence allows S-band communications from the completion of the landmark sighting sequence on the pseudo landing site landmark to the loss of MSFN line-of-sight.

Seventh Revolution (Figure 8)

The sequence of significant events that occur during the seventh revolution is as follows:

1. Landmark sighting on the second control point landmark
2. Acquisition of MSFN line-of-sight
3. Landmark sighting on the third control point landmark
4. Landmark sighting on the pseudo landing site landmark
5. Enter darkness
6. IMU realignment
7. Loss of MSFN line-of-sight
8. Enter sunlight
9. Landmark sighting on the first control point landmark

At the beginning of the seventh revolution, the CSM is in the locally fixed initial landmark tracking attitude. A Mode III type landmark sighting sequence is performed on the second control point landmark, and then the vehicle is maneuvered back to the locally fixed initial landmark tracking attitude for a Mode III type landmark sighting sequence on the third control point landmark (Table 2). Upon completion of the sighting on the third control point landmark, the CSM is maneuvered back to the locally fixed initial landmark tracking attitude for a Mode III type landmark sighting sequence on the pseudo landing site landmark. After the completion of the sighting sequence on the pseudo landing site landmark, the CSM is rolled 180 degrees to gain S-band communications, and the resulting attitude is held inertially fixed. This inertially fixed attitude satisfies the attitude requirements for the IMU realignment occurring approximately 13 minutes after the CSM enters darkness.

About three minutes before the CSM enters sunlight, the inertial attitude hold is terminated, and the CSM is maneuvered to the initial landmark tracking attitude for a Mode III type landmark sighting sequence on the first control point landmark. After the completion of the sighting sequence, the vehicle is maneuvered back to the locally fixed initial landmark tracking attitude for a Mode III type landmark sighting sequence, which occurs early in the eighth revolution on the second control point landmark. The initial landmark sighting attitude is held locally fixed through the completion of the seventh revolution.

This attitude sequence allows S-band communications from the completion of the landmark sighting sequence on the pseudo landing site landmark to the loss of MSFN line-of-sight.

Eighth Revolution (Figure 9)

The sequence of signficant events that occur during the eighth revolution is as follows:

1. Landmark sighting on the second control point landmark
2. Acquisition of MSFN line-of-sight
3. Landmark sighting on the third control point landmark
4. Landmark sighting on the pseudo landing site landmark
5. Enter darkness
6. IMU realignment
7. Dark side and solar corona photography
8. Loss of MSFN line-of-sight
9. Orbital navigation photography (convergent stereo photography)
10. Enter sunlight

At the beginning of the eighth revolution, the CSM is in the locally fixed initial landmark tracking attitude. A Mode III type landmark sighting sequence is performed on the second control point landmark, and then the vehicle is maneuvered back to the locally fixed initial landmark tracking attitude for a Mode III type landmark sighting sequence on the third control point landmark (Table 2). Upon completion of the sighting on the third control point landmark, the CSM is maneuvered back to the locally fixed initial landmark tracking attitude for a Mode III type landmark sighting sequence on the pseudo landing site landmark. After the completion of the sighting sequence on the pseudo landing site landmark, the CSM is rolled 180 degrees to gain S-band communications, and the resulting attitude is held inertially fixed. This inertially fixed attitude satisfies the attitude requirements for the IMU realignment occurring approximately nine minutes after the CSM enters darkness. Seventeen minutes before the CSM enters sunlight, the inertial attitude hold is terminated, and the CSM is maneuvered to an attitude which allows dark side and solar corona photography. The vehicle attitude, with respect

to the local horizontal orientation, is a pitch of minus 20 degrees and a roll of 180 degrees. This attitude is held locally fixed for 15 minutes. The CSM is then maneuvered to an attitude which allows orbital navigation photography. This vehicle attitude, with respect to the local horizontal orientation, is a pitch of minus 70 degrees and a roll of 180 degrees. This attitude is held locally fixed through the completion of the eighth revolution.

This attitude sequence allows S-band communications from the completion of the landmark sighting sequence on the pseudo landing site landmark to the maneuver to the dark side and solar corona photography attitude.

Ninth Revolution(Figure 10)

The sequence of significant events that occur during the ninth revolution is as follows:

1. Orbital navigation photography (convergent stereo photography)
2. Acquisition of MSFN line-of-sight
3. Enter darkness
4. IMU realignment
5. Loss of MSFN line-of-sight
6. Enter sunlight

At the start of the ninth revolution, the CSM is in the orbital navigation photography attitude. This attitude is held locally fixed until the CSM passes over the subsolar point. The CSM is then pitched 40 degrees and rolled 180 degrees, and the resulting attitude is held locally fixed while the convergent stereo photography continues. Approximately one minute after the CSM enters darkness, the local attitude hold is terminated, and the CSM is rolled 180 degrees and pitched minus 57.5 degrees. The resulting attitude is then held inertially fixed. This inertially fixed attitude satisfies the attitude requirements for the IMU realignment occurring approximately 15 minutes after the CSM enters darkness. At the loss of MSFN line-of-sight, the inertial attitude hold is terminated, and the CSM is maneuvered to a lunar observation attitude. The vehicle attitude, with respect to the local horizontal orientation, is a pitch of minus 90 degrees. This attitude is held locally fixed through the completion of the ninth revolution.

This attitude sequence allows S-band communications from 11 minutes prior to the termination of orbital navigation photography to the loss of MSFN line-of-sight.

Tenth Revolution (Figure 11)

The sequence of significant events that occur during the tenth revolution is as follows:

1. Acquisition of MSFN line-of-sight
2. Enter darkness

3. IMU realignment
4. Loss of MSFN line-of-sight
5. Enter sunlight
6. Transearth Injection (TEI) burn

At the start of the tenth revolution, the CSM is in the lunar observation attitude. This attitude is held locally fixed until immediately before the acquisition of MSFN line-of-sight. The CSM is then rolled 180 degrees for S-band communications, and the local attitude hold is continued. Approximately 20 minutes before the CSM enters darkness, the local attitude hold is terminated, and the existing attitude is held inertially fixed. This inertially fixed attitude satisfies the attitude requirements for the IMU realignment beginning as the CSM enters darkness. Approximately nine minutes before the CSM enters sunlight, the inertial attitude hold is terminated, and the vehicle is maneuvered to the TEI burn attitude. The burn attitude is then held inertially fixed through the burn. The TEI burn boosts the CSM from the 60-nautical mile circular lunar orbit into the transearth trajectory. The burn is performed with the CSM in a posigrade attitude, and the crew is heads down to afford visual reference with the lunar surface.

This attitude sequence allows S-band communications from acquisition of MSFN line-of-sight to loss of MSFN line-of-sight.

TABLE I.- C' LUNAR ORBIT EVENT TIMELINE

Mission Time Hr:Min:Sec	Event
69:11:35	LOI_1 cutoff, inertial attitude hold
69:29:00	Roll 180° for communications, inertial attitude hold
69:30:20	Acquire Canberra signal
70:14:20	Enter lunar umbra, begin IMU realignment
70:36:35	Acquire Madrid signal
70:54:58	Lose Madrid signal
70:55:13	Lose Canberra signal, maneuver to lunar observation and photography attitude, local attitude hold
71:00:26	Enter sunlight
71:38:25	Acquire Madrid signal
71:38:35	Acquire Canberra signal
72:08:30	Lose Canberra signal
72:15:00	Terminate local attitude hold and begin inertial attitude hold
72:22:47	Enter lunar umbra
72:27:00	Begin IMU realignment
72:55:00	Maneuver to circularization burn attitude except rolled 180°, inertial attitude hold
73:03:18	Lose Madrid signal
73:05:00	Roll 180° to circularization burn attitude, inertial attitude hold
73:09:01	Enter sunlight
73:30:53	Initiate circularization burn
73:31:03	Circularization burn cutoff, inertial attitude hold

TABLE I.- C' LUNAR ORBIT EVENT TIMELINE - Continued

Mission Time Hr:Min:Sec	Event
73:40:00	Maneuver to landmark training photography attitude, local attitude hold
73:47:48	Acquire Madrid signal
74:14:16	Start manual pitch rate for landmark training photography
74:16:33	Terminate pitch rate, pitch up for IMU realignment, inertial attitude hold
74:22:53	Enter lunar umbra
74:30:00	Begin IMU realignment
74:55:00	Maneuver to orbital navigation photography attitude, local attitude hold
74:59:49	Lose Madrid signal
75:09:00	Enter sunlight
75:44:00	Roll 180°, continue orbital navigation photography, local attitude hold
75:46:11	Acquire Madrid Signal
76:00:00	Maneuver to landmark evaluation attitude, local attitude hold
76:10:20	Start -.3°/sec pitch rate for landmark evaluation
76:14:49	Terminate pitch rate, roll 180°, inertial attitude hold
76:21:29	Enter lunar umbra
76:30:00	Begin IMU realignment
76:58:10	Lose Madrid signal
77:00:00	Maneuver to landmark sighting attitude, local attitude hold
77:07:35	Enter sunlight
77:30:19	Start -.3°/sec pitch rate for control point landmark sighting
77:34:48	Terminate pitch rate, maneuver to landmark sighting attitude, local attitude hold

TABLE I.- C' LUNAR ORBIT EVENT TIMELINE - Continued

Mission Time Hr:Min:Sec	Event
77:44:32	Acquire Madrid signal
78:08:09	Acquire Goldstone signal
78:08:36	Start -.3°/sec pitch rate for pseudo landing site sighting
78:13:05	Terminate pitch rate, roll 180°, inertial attitude hold
78:20:05	Enter lunar umbra
78:35:00	Begin IMU realignment
78:56:11	Lose Goldstone signal
78:56:32	Lose Madrid signal
79:06:00	Maneuver to landmark sighting attitude, local attitude hold
79:06:12	Enter sunlight
79:28:36	Start -.3°/sec pitch rate for control point landmark sighting
79:33:05	Terminate pitch rate, maneuver to landmark sighting attitude, local attitude hold
79:42:30	Acquire Goldstone signal
79:42:51	Acquire Madrid signal
80:06:52	Start -.3°/sec pitch rate for pseudo landing site sighting
80:11:21	Terminate pitch rate, roll 180°, inertial attitude hold
80:18:41	Enter lunar umbra
80:32:00	Begin IMU realignment
80:54:28	Lose Goldstone signal
80:54:50	Lose Madrid signal
81:00:00	Maneuver to landmark signting attitude, local attitude hold
81:04:48	Enter sunlight
81:12:25	Start -.3°/sec pitch rate for control point landmark sighting

TABLE I.- C' LUNAR ORBIT EVENT TIMELINE - Continued

Mission Time Hr:Min:Sec	Event
81:16:54	Terminate pitch rate, maneuver to landmark sighting attitude local attitude hold
81:26:53	Start -.3°/sec pitch rate for control point landmark signting
81:31:22	Terminate pitch rate, maneuver to landmark sighting attitude, local attitude hold
81:40:51	Acquire Goldstone signal
81:44:48	Start -.3°/sec pitch rate for control point landmark sighting
81:49:17	Terminate pitch rate, maneuver to landmark sighting attitude, local attitude hold
82:05:08	Start -.3°/sec pitch rate for pseudo landing site sighting
82:09:37	Terminate pitch rate, roll 180°, inertial attitude hold
82:17:17	Enter lunar umbra
82:30:00	Begin IMU realignment
82:52:49	Lose Goldstone signal
83:00:00	Maneuver to landmark sighting attitude, local attitude hold
83:03:24	Enter sunlight
83:10:42	Start -.3°/sec pitch rate for control point landmark sighting
83:15:11	Terminate pitch rate, maneuver to landmark sighting attitude, local attitude hold
83:25:09	Start -.3°/sec pitch rate for control point landmark sighting
83:29:38	Terminate pitch rate, maneuver to landmark sighting attitude, local attitude hold
83:39:13	Acquire Goldstone signal
83:43:05	Start -.3°/sec pitch rate for control point landmark sighting
83:45:31	Acquire Canberra signal
83:47:34	Terminate pitch rate, maneuver to landmark sighting attitude, local attitude hold

TABLE 1.- C' LUNAR ORBIT EVENT TIMELINE - Continued

Mission Time Hr:Min:Sec	Event
84:03:24	Start -.3°/sec pitch rate for pseudo landing site sighting
84:07:53	Terminate pitch rate, roll 180°, inertial attitude hold
84:15:54	Enter lunar umbra
84:25:00	Begin IMU realignment
84:45:00	Maneuver to darkside and solar corona photography attitude, local attitude hold
84:50:47	Lose Canberra signal
84:51:14	Lose Goldstone signal
85:00:00	Maneuver to orbital navigation photography attitude, local attitude hold
85:02:00	Enter sunlight
85:37:00	Pitch 40°, roll 180° and continue orbital navigation photography, local attitude hold
85:37:06	Acquire Canberra signal
85:37:35	Acquire Goldstone signal
86:14:30	Enter lunar umbra
86:16:00	Roll 180°, pitch up for IMU realignment, inertial attitude hold
86:30:00	Begin IMU realignment
86:49:05	Lose Canberra signal
86:49:35	Lose Goldstone signal
86:50:00	Maneuver to lunar observation attitude, local attitude hold
87:00:37	Enter sunlight
87:35:00	Roll 180°, continue lunar observation, local attitude hold
87:35:27	Acquire Canberra signal
87:35:54	Acquire Goldstone signal

TABLE I.- C' LUNAR ORBIT EVENT TIMELINE - Concluded

Mission Time Hr:Min:Sec	Event
87:53:00	Terminate local attitude hold, start inertial attitude hold
88:13:05	Enter lunar umbra, begin IMU realignment
88:47:25	Lose Canberra signal
88:47:53	Lose Goldstone signal
88:50:00	Maneuver to TEI burn attitude, inertial attitude hold
88:59:12	Enter sunlight
89:04:02	Initiate TEI burn

TABLE II.- SCANNING TELESCOPE SIGHTING TARGETS

Launch Date: December 21, 1968

Landing Site: II-P-2

Type	Latitude	Longitude	Altitude (meters)
First control point landmark	4.200° S	164.300° W	0.0
Second control point landmark	12.500° S	151.500° E	0.0
Third control point landmark	8.500° S	96.000° E	0.0
Pseudo landing site landmark	2.570° N	35.000° E	-890.0

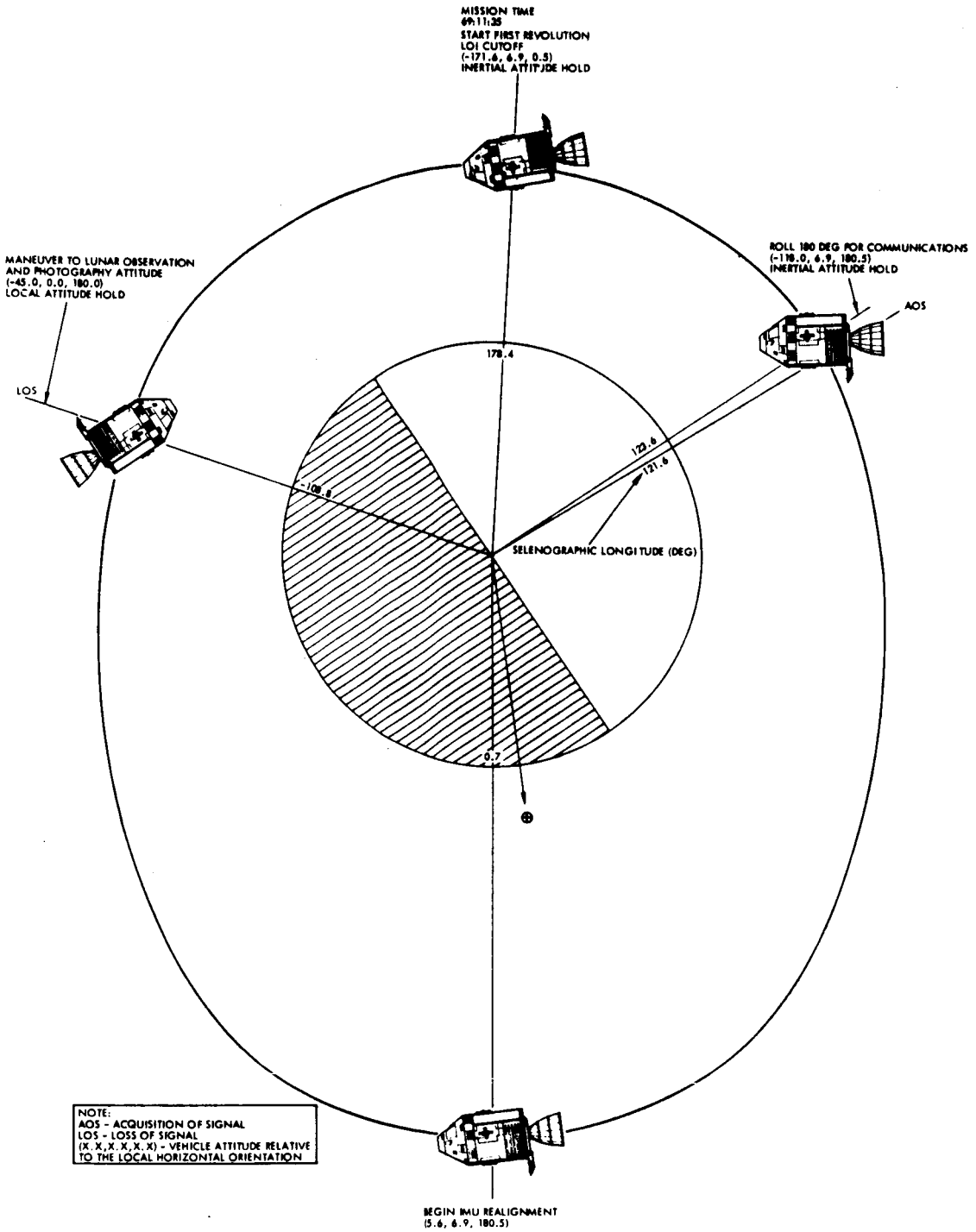

Figure 1.- First revolution major events and attitudes.

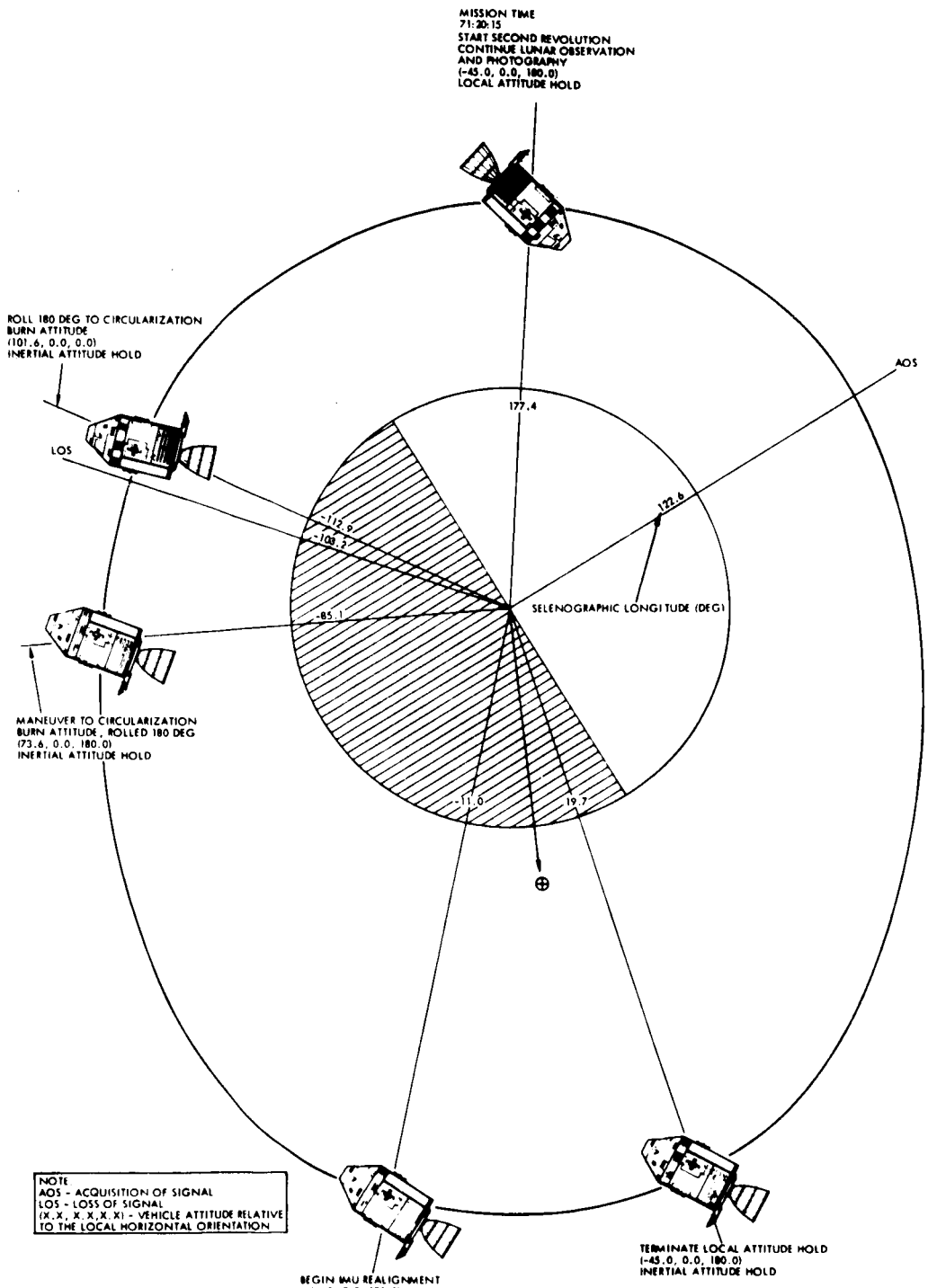

Figure 2.- Second revolution major events and attitudes.

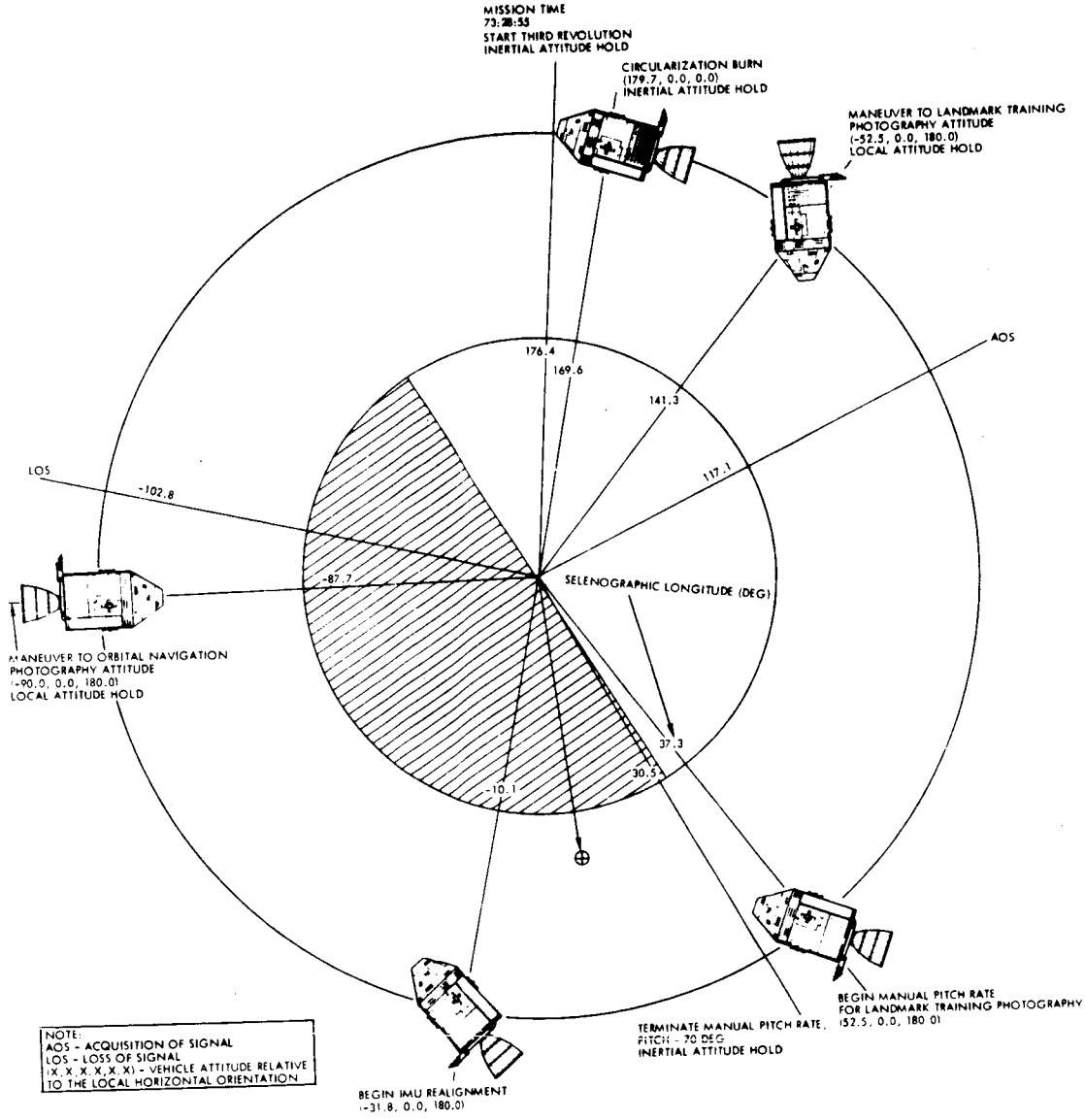

Figure 3.- Third revolution major events and attitudes.

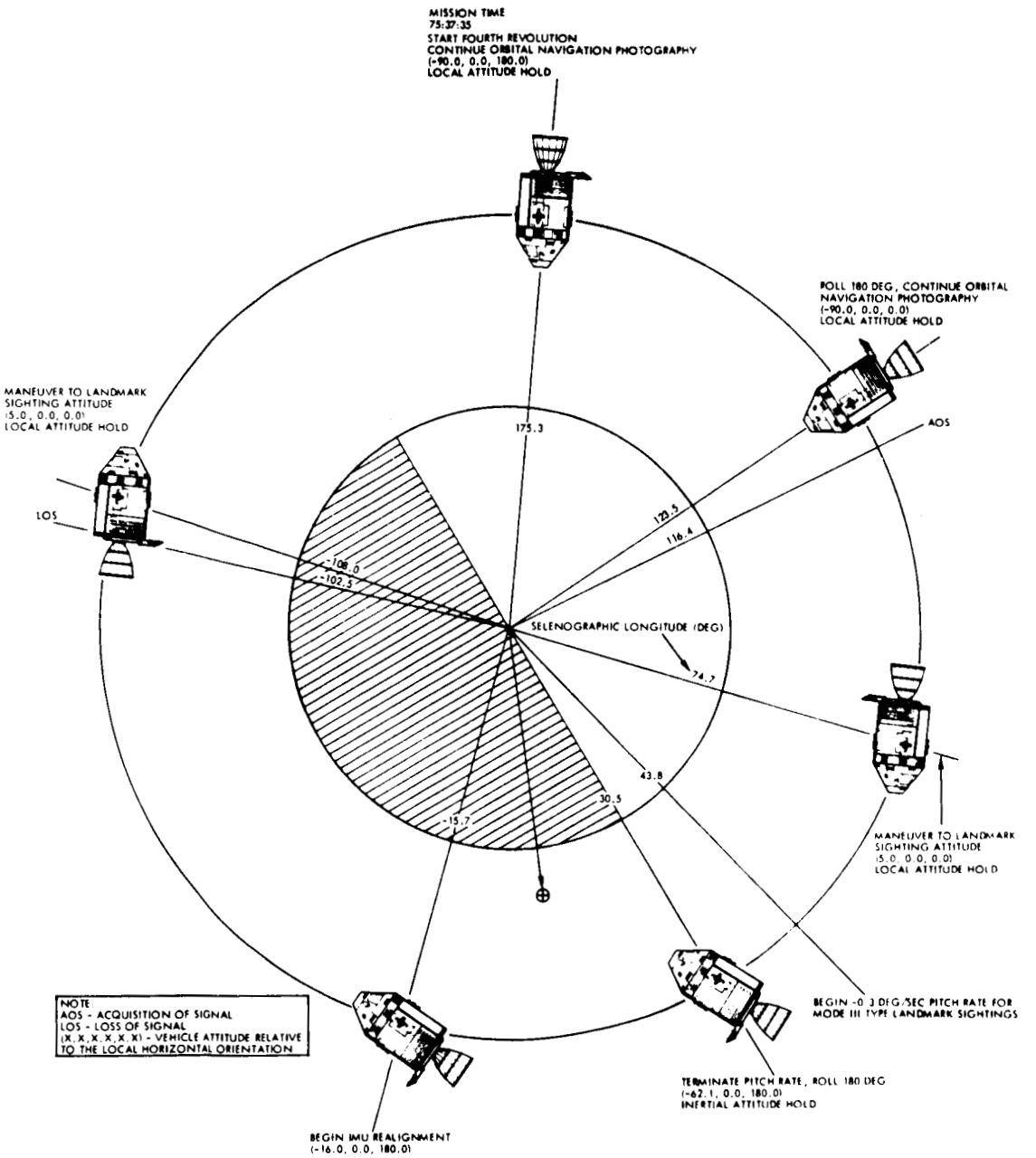

Figure 4.- Fourth revolution major events and attitudes.

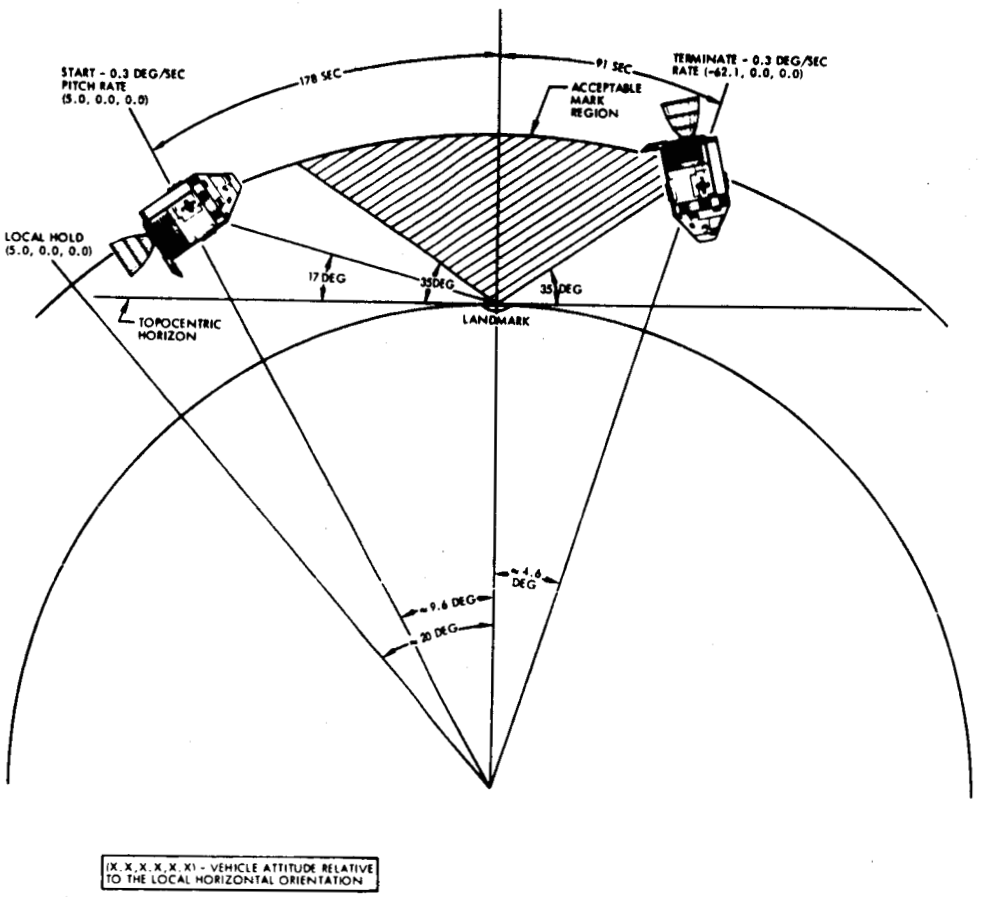

Figure 5.- Mode III-type landmark sighting attitude sequence.

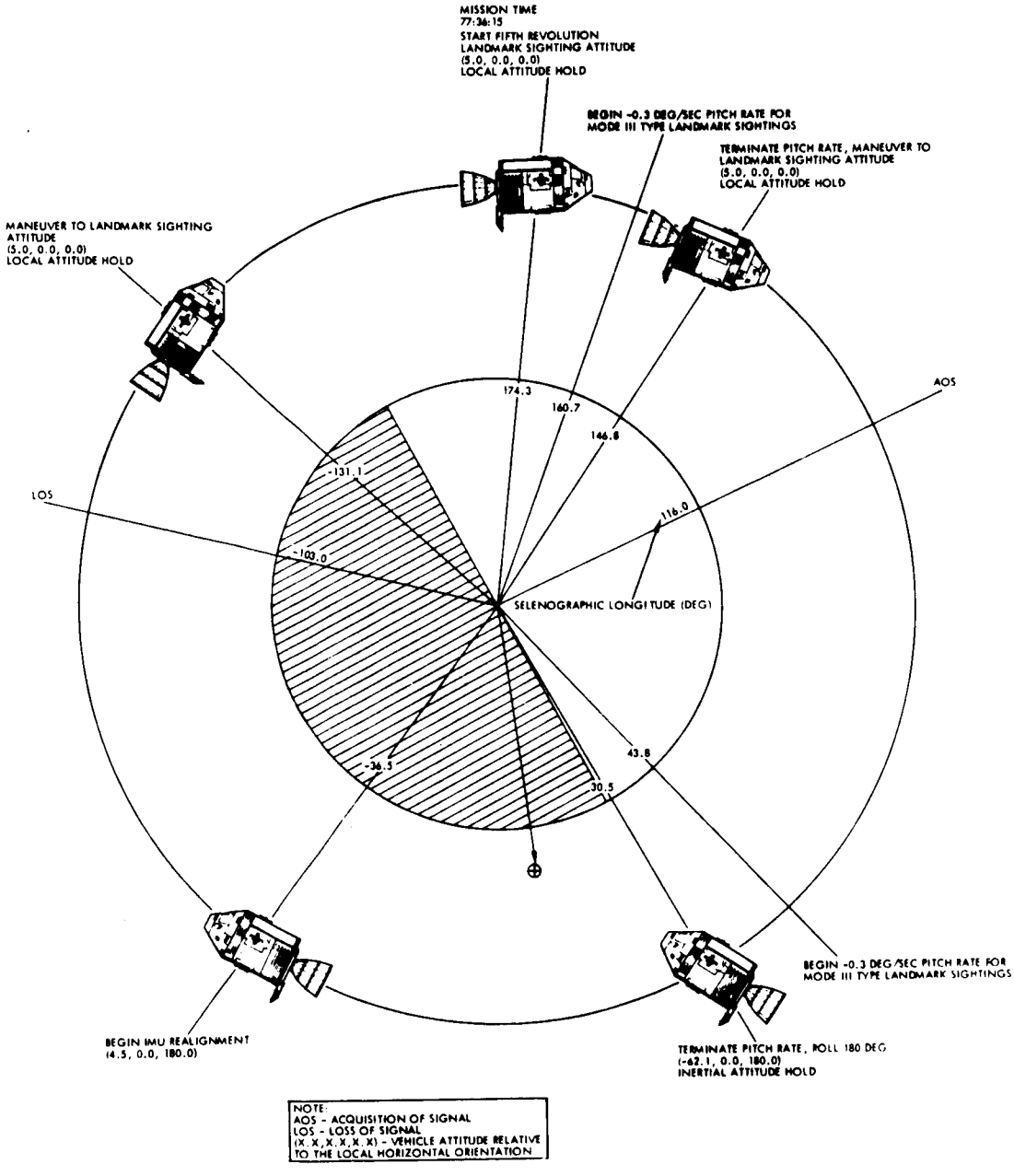

Figure 6.- Fifth revolution major events and attitudes.

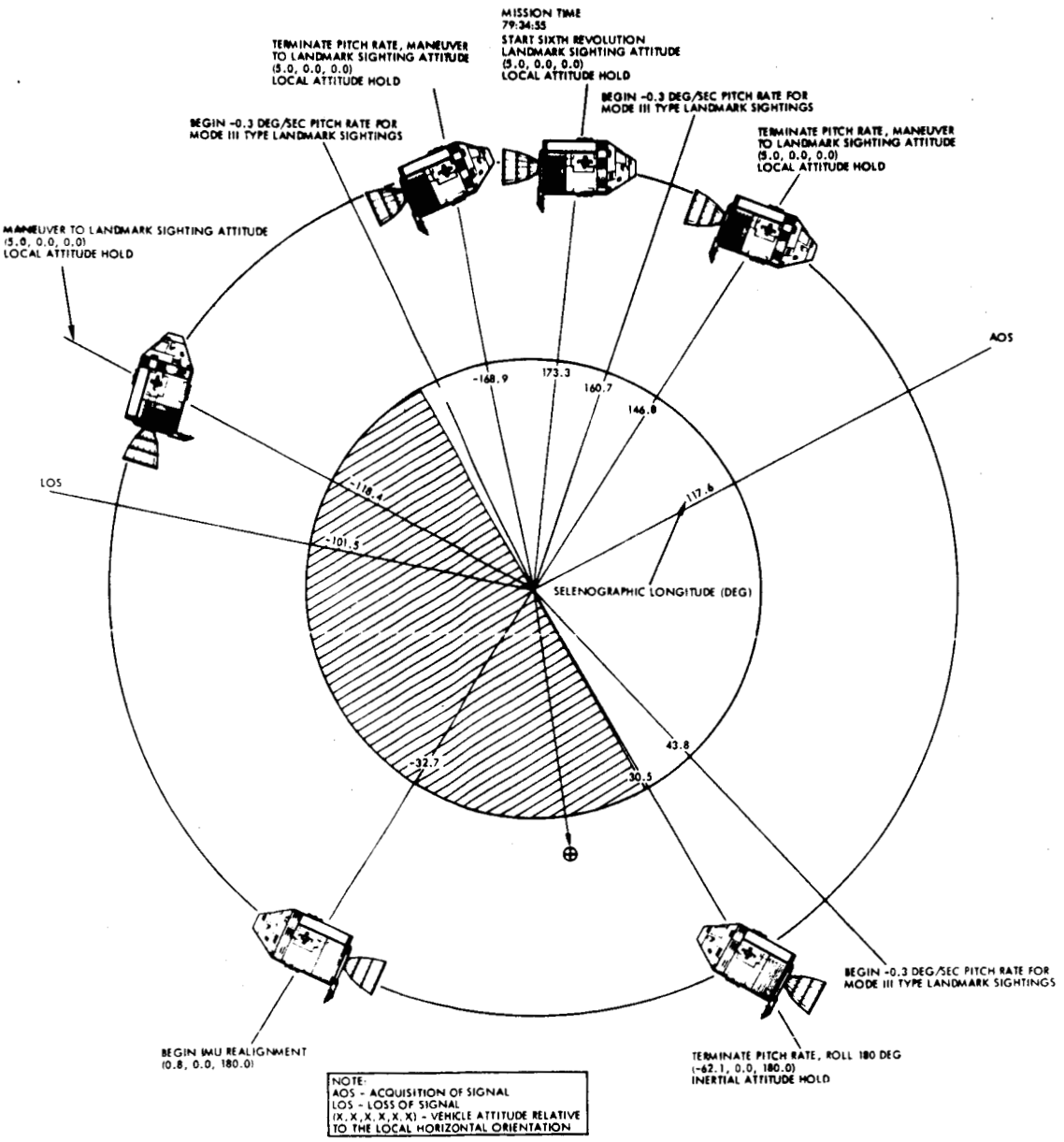

Figure 7.- Sixth revolution major events and attitudes.

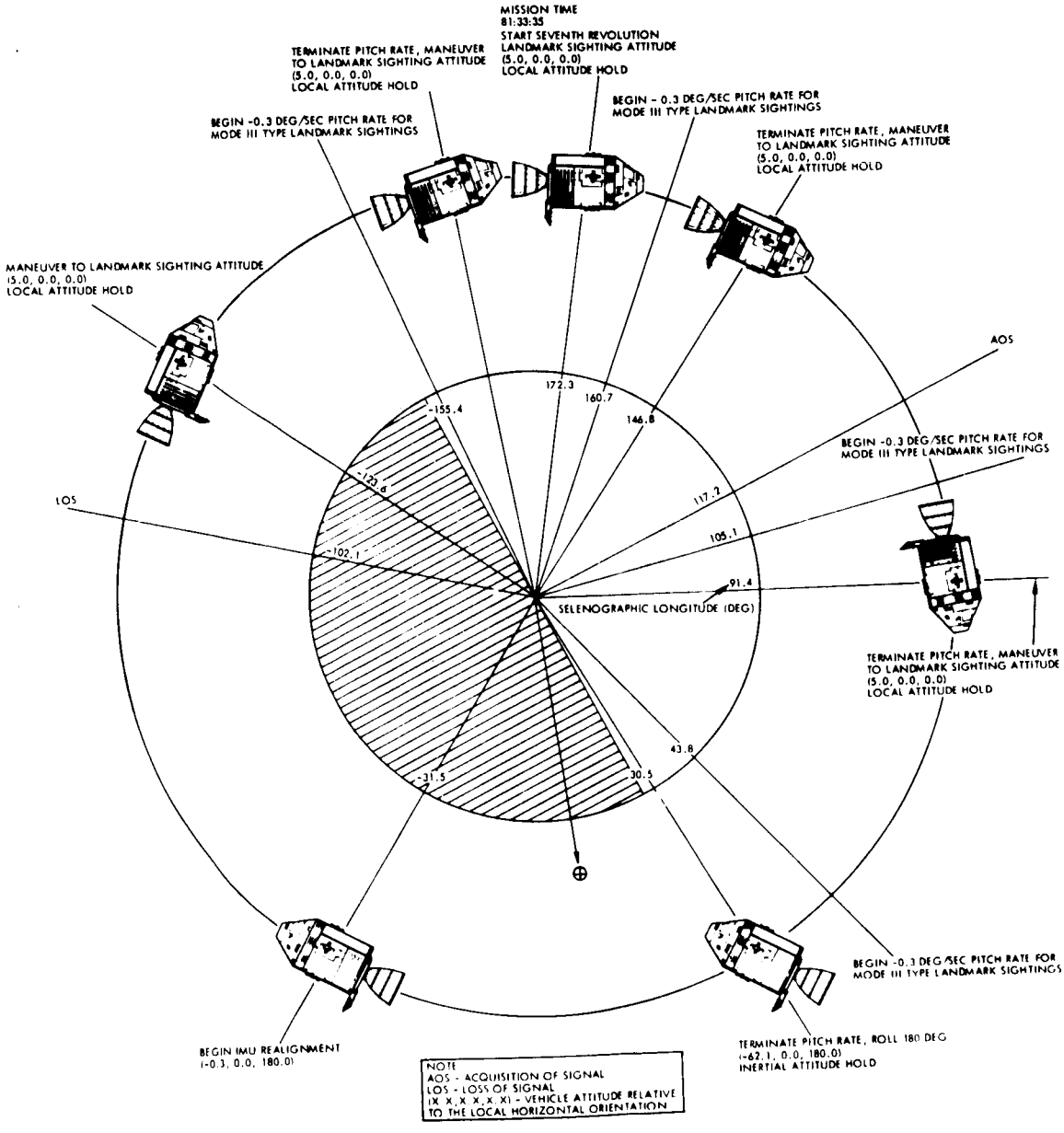

Figure 8.- Seventh revolution major events and attitudes.

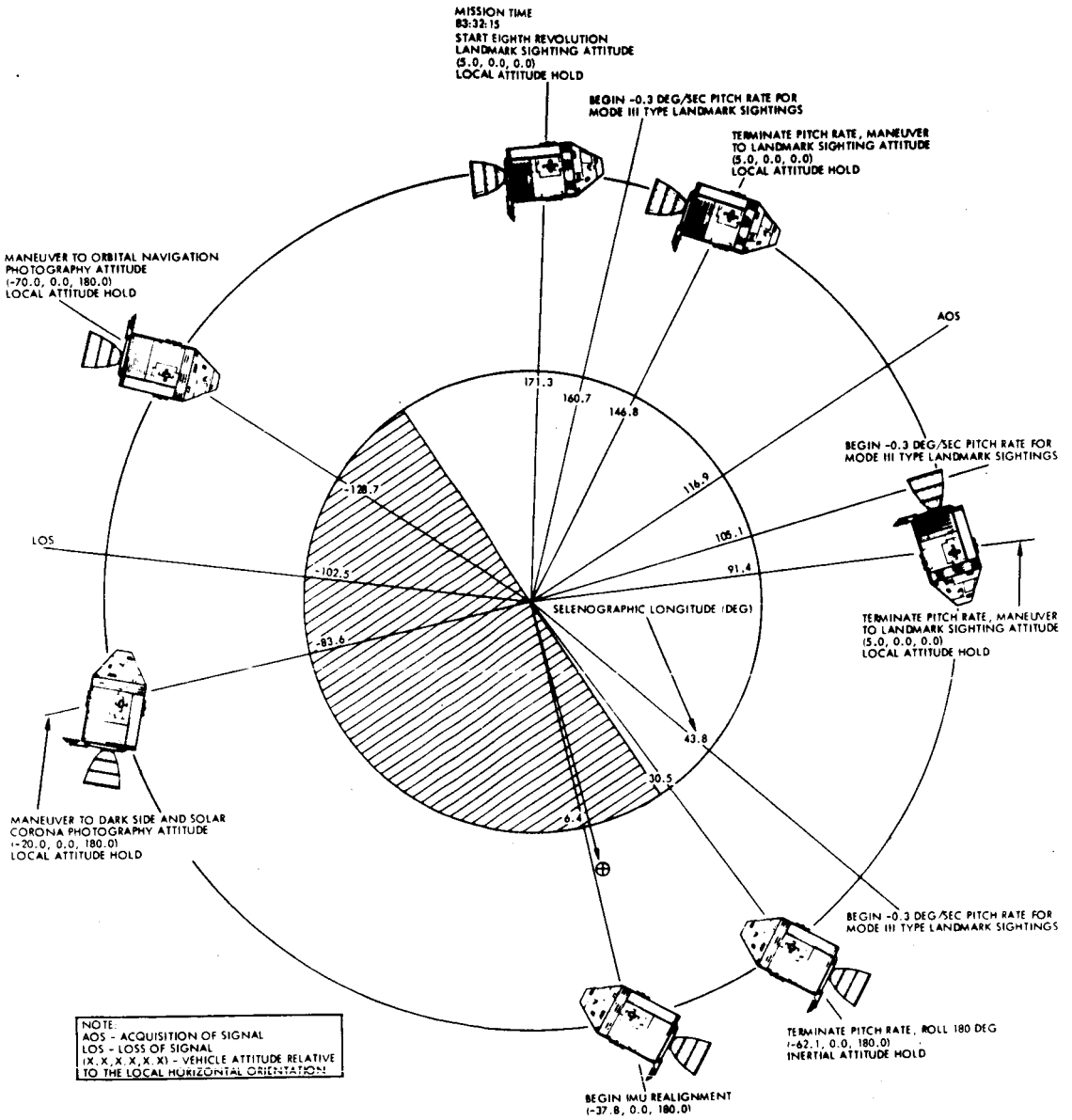

Figure 9.- Eighth revolution major events and attitudes.

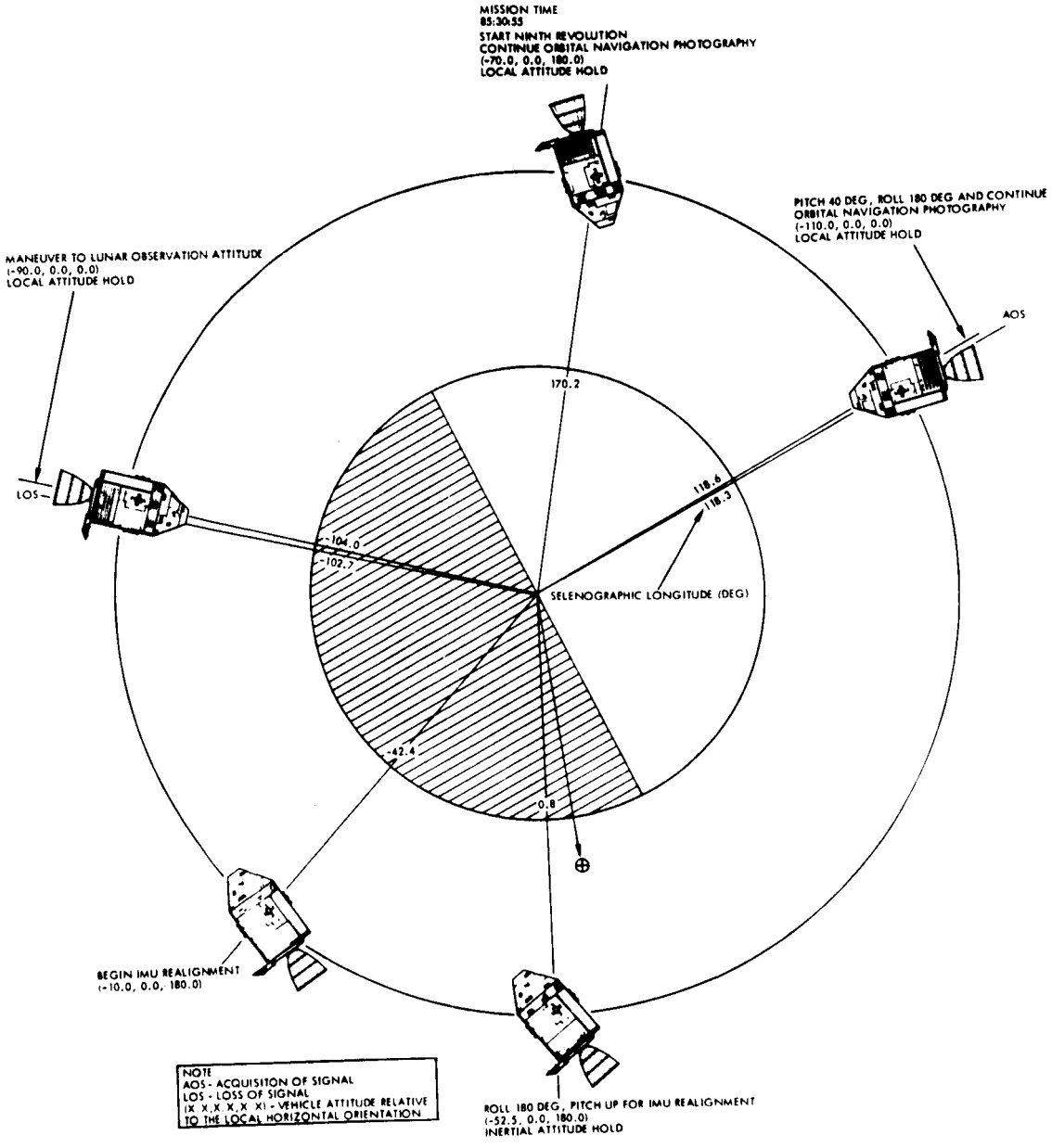

Figure 10.- Ninth revolution major events and attitudes.

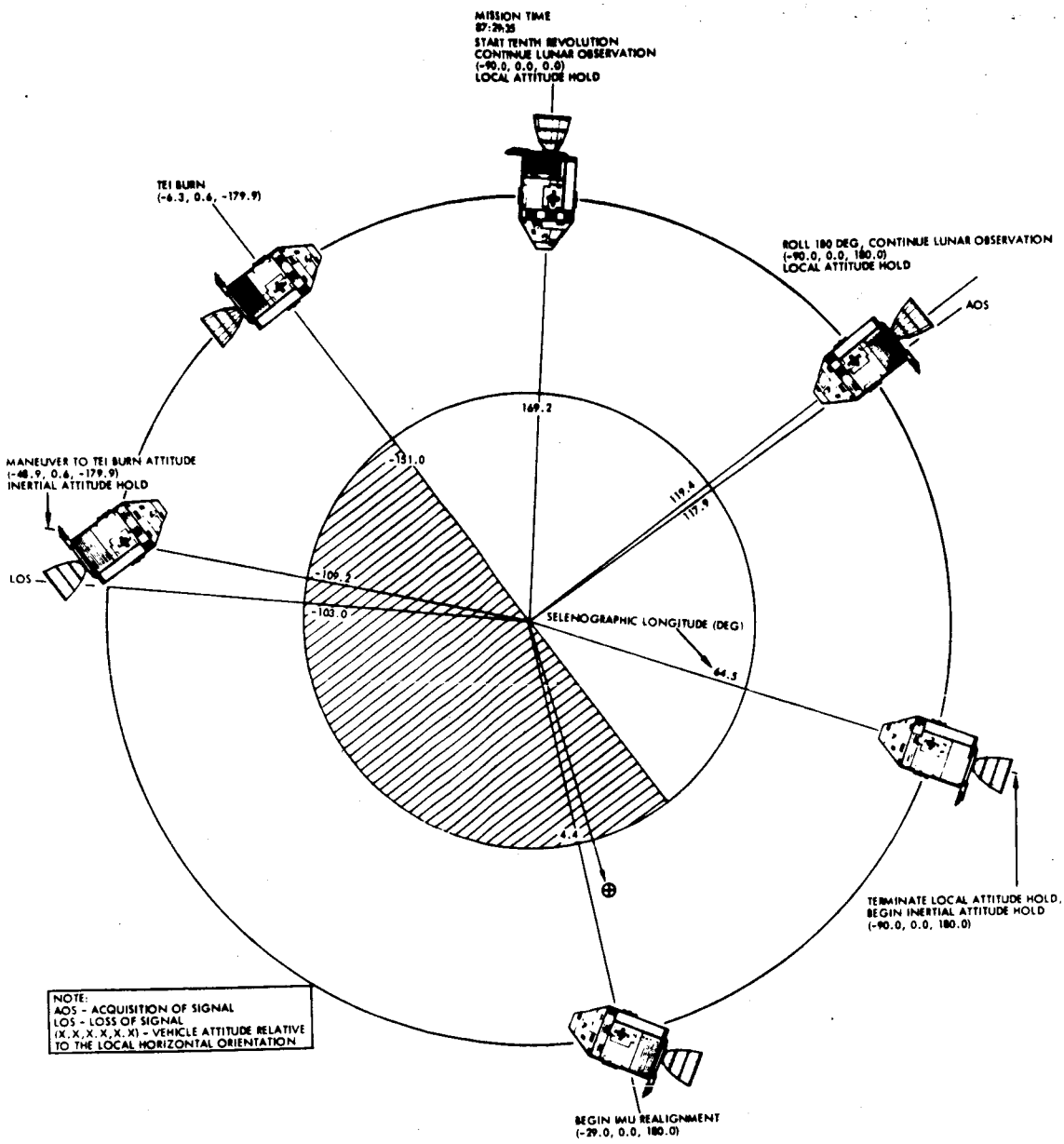

Figure 11.- Tenth revolution major events and attitudes.

REFERENCE

"Preliminary Flight Plan Apollo 8," NASA MSC Document CF 342-8M-156, 8 October 1968.